shot out from the mountain in all directions, zigzagging and flickering flashes alternating with, or being accompanied by, reddish globes, which ascended and exploded, and shot out stars and long rays. Away towards the south-west was another large focus of electric energy, which appeared to me to have a distinct relation to the volcanic electric discharges from Mont Pelée. This spot was, I reckoned, at least forty miles from the volcano, from which it bore almost west two points north. This latter electrical display was similar, but less extensive than that from Mont Pelée, and it was accompanied by curious glowing globes, which burst and shot out tongues of lightning. The most curious part of the magnificent sight, however, was that occasionally long rays of light, very like to the rays of a searchlight, shot out from the direction of Mont Pelée downwards to the secondary and distant electrical display, and on this broad ray reaching the western focus, the lightning there became more vivid, intense and extensive.

The West Indian volcanic explosions are undoubtedly due to the irruption of water into the reservoirs feeding the volcanoes. There are no large rivers or lakes that could supply water in sufficient quantity to produce the phenomena observed. Clearly, then, the sea has got in by some fissure or dislocation, and it has occurred to me that the electrical display to the west of Pelée observed on the night of August 28 was caused by a fissure in the sea bottom permitting an irruption of water into the reservoir from whence the volcano has obtained the material for its solid ejecta. Anyhow, the disastrous eruption of Pelée on the 30th—that is, two days afterwards—was accompanied by an enormous discharge of steam and hot water, much greater, indeed, than in the case in the earlier eruptions.

In the neighbourhood of the volcanoes there has been much alteration of the bottom of the Caribbean Sea. The cable-repairing ships report the depth in places to have increased by half a mile. On September 19, a telegram from the West Indian and Panama Telegraph Company stated that:—

"Unprecedented difficulties have been encountered in the endeavour to repair the interrupted cables between St. Lucia and St. Vincent and St. Lucia and Grenada. The cables appear to be buried under a layer of volcanic mud, and this, combined with the great depth of water, which can only be attributed to the alteration of the sea-bed due to the late eruptions, has rendered it difficult to raise the cable to the surface in consequence of the enormous strain. The repair of the St. Lucia—St. Vincent section, which was effected on the 16th instant after several weeks' operation, has been a very costly one, necessitating an expenditure of over thirty miles of new cable, and the fresh interruption which occurred in this section during the night of the 17th is in this new cable put down only the day before, and was evidently caused by some submarine disturbance."

Since the loss of the *Grappler* during the destruction of St. Pierre, no attempt has been made to repair the cable between Dominica and Martinique, so there is no recent authentic information concerning the disturbance of the sea bottom near to Mont Pelée; but Captain McKay, the Superintendent of the Quebec Steam Ship Co., who went south in the s.s. *Korona* on August 29, reported that "the sea between Dominica and Martinique was of a light green colour, which makes one think there was shoal water." This colour was due, doubtless, to the suspended ash which has fallen into this portion of the sea in enormous quantities from time to time, and it is to be expected that there has been a subsidence instead of an upheaval of the sea bottom to the west of Martinique.

August 30.—There were detonations in the afternoon, with slight vibrations of the earth; and at 7 p.m. there were exceedingly loud detonations and growlings, which continued at intervals until 2 a.m. on August 31. Volcanic ash began to fall at 5.30 p.m., and, as the night wore on, the fall was so great that the darkness became intense. The ash came from the east, so that evidently it was shot high into the upper strata of the atmosphere and carried to the north-east before it began to fall into the lower regions swept by the "trades." Later on, news came that the fall of ash in Guadeloupe was very heavy. In Montserrat the fall was lighter, and in Antigua it was lighter still.

August 31.—The fall of ash in Roseau (at the south-western end of the island) covered the surface to the depth of a quarter of an inch; the dust penetrated everywhere, closed drawers and presses being insufficient to keep out the finer particles.

September 1.—The atmosphere is still dust-laden, and the sun was obscured all day; it could be seen only towards the evening, when it set like a dull greenish disc. In the afternoon heavy ash clouds were drifting to the west through the Martinique Channel.

September 2.—Mr. A. Robinson, the Government Officer at the eastern side of the island, reports to me that the ash fell there on the night of August 30 to the depth of from an inch to two inches, that small trees and branches of large ones were broken down by the weight of the dust, which clung tenaciously to the leaves, branches and stems, and that the cattle were suffering from hunger, as the grass was covered and grazing was impossible.

September 3.—The mail steamer came in to-day from the south, and brought some refugees from Morne Rouge, which was destroyed by the eruption of Mont Pelée on the night of August 30. There was a French priest on board who was an eye-witness of the disaster. The following statement he made was kindly written down for me by Mr. C. A. Seignoret, the Quarantine Officer:—

"The phenomena were entirely new, and hot water and red-hot dust were the principal elements of destruction amongst the inhabitants of Morne Rouge and Carbet. Several houses were completely destroyed, while others sustained no damage."

Mr. Seignoret has also kindly interviewed one of the intelligent refugees for me, and he has furnished me with the following statement made by her:—

"Miss Carra, a respectable resident at Morne Rouge, who was an eye-witness to the eruption of Mont Pelée which occurred on August 30 last, informed me that rumbling noises were heard from the crater all day, with detonations and frequent flashes of electricity, and towards evening the mountain appeared to be a mass of flame, emitting alternately jets of hot water and red-hot ashes, which ascended into the air in the form of rockets, and as the ashes fell upon the wooden housetops, the buildings at once caught fire. A great many lives were destroyed by hot ashes and water, for numbers of persons rushed from their houses into the streets to escape from the flames, and as the ashes fell upon their faces and other exposed portions of their bodies, the skin at once became red as scarlet and peeled off, causing the parts to swell to an enormous size. In most cases, portions of the legs, arms and chest were burnt, while the clothes were intact. White persons got completely charred in the face, causing them to appear like coal-black negroes. Some of the gendarmes were found dead in fixed positions with their clothing quite sound, while others were burnt in various parts of their bodies. Water! Water! was the only cry from the wounded and dying, and in many instances death ensued immediately after their thirst was quenched."

This interesting account indicates that there was an ejection of much larger quantities of steam and hot water than occurred in the earlier eruptions. Persons who shut themselves close in their houses were nearly all saved, the hot blast passing quickly, but from other accounts I have received it appears that the heat was fearful for a brief period and that the rapid evaporation of moisture from the tissues caused a thirst that was agonising until assuaged.

About 1500 persons were killed and, according to the statements of *L'Opinion* of Fort-de-France, a greater number have suffered injuries.

H. A. ALFORD NICHOLLS.

ASTRONOMY AND COSMICAL PHYSICS AT THE BRITISH ASSOCIATION.

AT the Bradford meeting, in 1900, a department of astronomy was established as a subsection of Section A, in deference to a wish that had been expressed that astronomy should be better represented at the British Association. After two years' experience, it was felt that the astronomical papers that were received were scarcely enough to justify this division of Section A, and this year the subsection was strengthened by the addition of cosmical physics. On the Friday the whole section was given up to cosmical physics; on the Monday and Tuesday the subsection met separately. On all three days the room was well filled, and it was apparent that the enlarged subsection was in some ways a success. But towards the end of the meeting there was a strong expression of opinion that it is not to the advantage of the section as a whole that it should be so much subdivided, and the whole matter will have to be carefully considered before next year. Perhaps a solution of the difficu

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might be found in the division of all papers for Section A into two classes—papers that are generally intelligible and papers that are not—and in relegating the latter class only to sub-sectional meetings. It is not impossible that this might have beneficial results in more ways than one.

The address of the chairman, Prof. Schuster, has already been printed in full. His criticisms of mere routine observation raised an interesting discussion, in which the meteorologists reserved their defence.

Among the papers submitted to the subsection were several of general interest. Major S. G. Burrard, R.E., described the difficulties which are caused in the Geodetic Survey of India by the attraction of the mass of the Himalayas and the Thibet plateau, and by the existence of an underground chain of excessive density which runs across India. Contrary to the opinion that was held until a few years ago, it now seems certain that the plumb-line is deviated over the whole of India, and that all astronomical latitudes may be in error by a number of seconds of arc. The Government of India and the staff of the Survey must be congratulated on their good fortune in being confronted with problems of such interest and importance. Prof. Turner described an attempt made at Oxford to verify the suggestion put forward by Sir David Gill that the bright stars, as a whole, are rotating relatively to the fainter stars. From the Oxford astrographic catalogue plates he finds distinct evidence of such an effect, but with a sign opposite to that found by Gill in the southern hemisphere.

The feature of the meeting on September 16 was an exhibition of photographs from the Yerkes Observatory. Mr. Ritchey has made a most interesting set of pairs of photographs of star clusters, made respectively with a 2-foot reflector and with the 40-inch visual refractor fitted with a colour screen used in contact with isochromatic plates. With the latter, the densest parts of the clusters are beautifully resolved and measurable. The photographs of nebulæ made with the 2-foot are unsurpassed; and it is remarkable how, though nearly all the detail which they show *can be found* on the photographs taken at Crowborough and Daramona and Greenwich, the general effect is in some cases quite different. Mr. Percival Lowell sent three papers, one describing a scheme for sending expeditions in search of good "seeing." Mr. S. A. Saunder discussed the possibility of changes in the surface of the moon, and urged the need of cooperation in the work of describing minute detail. Mr. W. E Wilson reported failure in his search for Forbes's hypothetical extra-Neptunian planet, and showed a bolometer mounted equatorially for measuring solar radiation.

Other papers read at the meetings of the subsection have already been mentioned in NATURE in the notes of mathematical and physical papers.

A. R. H.

ZOOLOGY AT THE BRITISH ASSOCIATION.

ON September 11, in addition to the reports of committees, a short series of fisheries papers was taken:—

(1) Prof. McIntosh, who was prevented from being present, sent a detailed paper discussing British fisheries investigations and the international scheme, which was read in abstract to the meeting by Mr. W. S. Green, Chief Inspector of Fisheries for Ireland. He showed the necessity for improved statistics and for a careful survey of the off-shore and in-shore fishing grounds. He considered that hydrographical work occupied too prominent a position in the international scheme and that other more important points in connection with the distribution of fish have been omitted. (2) Mr. W. Garstang then read a statement as to the proposed programme for the international investigation of the North Sea, as passed at the recent meeting of delegates at Copenhagen. He stated that in his opinion all the investigations thought desirable by Prof. McIntosh and other critics were included in the Christiania scheme, and that that scheme was going to be carried out practically unchanged. He explained that the Government had had to adopt hydrography as a part of the proposed programme, although its importance in connection with English fishery interests might be doubtful. Finally, he urged the advantages of international cooperation. (3) Dr. Noel Paton, who was prevented from being present, sent a paper criticising the methods proposed in the international scheme, and throwing doubt upon the accuracy and value of results based upon such methods. Dr. Masterman, Dr. Mill and others spoke in the discussion which followed. (4) Mr. J. Stuart Thomson had paper on the scales of fishes as an index of age.

The following were the reports of committees submitted to the Section:—

(1) "Migration of Birds," mainly the work of Mr. W. Eagle Clarke on the fieldfare and the lapwing. (2) "Naples Zoological Station," containing reports on work by Mr. E. S. Goodrich, Mr. N. Maclaren, Miss A. Vickers and Dr. R. N. Wolfenden, in addition to the usual statistics from the station. (3) "Plymouth Marine Laboratory," with a short report from Mr. H. M. Woodcock. (4) "Index Animalium." Vol. i. of this work, by Mr. Sherborn, will be issued in October. (5) "Plankton Investigation." (6) "Zoology of Sandwich Islands." (7) "Millport Marine Zoological Station." And (8) "Coral Reefs of the Indian Region." Mr. Stanley Gardiner reports considerable progress with the publication of his results.

The forenoon of September 12 was devoted to a series of papers, by Prof. Herdman and those who are helping him to work out his results, on the fauna and flora associated with the pearl oyster banks in the Gulf of Manaar. First, Prof. Herdman gave a general account, illustrated by the lantern, of his recent expedition to Ceylon, with a description of the pearl fisheries. Then followed:—Mr. A. O. Walker, on the Amphipoda, Mr. I. C. Thompson, on Indian Ocean Copepoda, Mr. W. E. Hoyle, on the cuttlefishes, and Mr. J. Lomas, on the marine deposits dredged by Prof. Herdman. Prof. Dendy, Mr. Stanley Gardiner and others took part in the discussion that followed. The remaining papers before the Section that day were:—(1) Prof. Cleland, on a hitherto unrecorded element in the occipital bone of seals. (2) Prof. Poulton, on the habits of the predaceous flies of the family Asilidæ, with exhibition of specimens. (3) Prof. E. W. MacBride read a paper on some new points in the development of *Echinus esculentus*. He stated that in order to obtain successful cultures of the larvæ it was necessary to use perfectly ripe parents and to supply the growing larvæ with an abundance of sea water, frequently changed. He pointed out that many cultures on which important conclusions were based were made under insanitary conditions. The cavity of the blastula was at first filled with a thick proteid solution which became thinner as development advanced, and this thinning was possibly connected with the infolding processes in the wall, by means of which the organs of the larva were built up. The larva showed its relationship to Tornaria by the three-fold division of the body cavity on each side and by a larval brain, which was situated at the front end and was independent of the ciliated band. The development of the nerve-ring of the Echinus from the floor of an ectodermic pit was described. A false floor formed over this by the meeting of interradial ridges gave rise to the buccal membrane of the adult. The masticatory apparatus was derived from five pocket-like outgrowths of the left posterior body cavity. Finally, the blood system was a remnant of the proteid contents of the blastocœle added to by exudation from the cells of the alimentary canal. (4) Dr. A. T. Masterman exhibited a series of wax models illustrating the transition from larva to adult in *Cribrella oculata*. The main points brought out were the complete bilaterality of the larva, the sinistral asymmetry followed by axial symmetry converting the larva into adult, and the absence of any true metamorphosis. The changes in the body cavities were shown to agree with the results of Goto for Asterina and Asterias, and to differ from those of MacBride. (5) Dr. J. Hume Patterson gave an important communication, on the causes of salmon disease—a bacteriological investigation, in which he showed that if a sound salmon is placed in water with Saprolegnia there is no result, and that the fungus is effectual only after a preliminary softening of the skin by the action of a bacillus which he had succeeded in isolating and cultivating.

On Monday, September 15, the following papers, &c., were taken:—

(1) Prof. Howes exhibited, on behalf of Mr. J. P. Hill, of Sydney, photographs of the first segmentation stages of the zygote of the native cat (Dasyurus) up to the period of first formation of the endoderm. A 16-celled stage was described, at which the embryo-cells are arranged in a couple of annuli, and later a stage suggestive of over growth of a yolk by the ectoderm. Selenka's blastopore stage was shown to be conspicuous, and in one example the endoderm appeared to arise from a single cell at the point of closure of the blastopore, after the manner of that of Didelphys. Mr. Hill has succeeded in obtaining microscopic

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